

AIR COMMAND AND STAFF COLLEGE

AIR UNIVERSITY

THE JOINT CAPABILITIES INTEGRATION AND DEVELOPMENT SYSTEM:
ITS IMPACT ON AIR FORCE ACQUISITION THIRTEEN YEARS LATER

by

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Abstract

Today's joint force followed a long and winding road before every Major Defense Acquisition Program (MDAP) requirement fell under the oversight of the Chairman of the Joint Chiefs of Staff's Joint Requirements Oversight Council (JROC). By 2003, the JROC's processes evolved again with the publication of the Joint Capabilities Integration and Development System (JCIDS). A fully interoperable and integrated joint force was now on the horizon due to JCIDS, but what was the resultant impact of JCIDS on Air Force MDAP acquisition schedules?

This research compares the acquisition timelines of MDAP developed before and after 2003 to determine the impact JCIDS had on Air Force acquisition since then, good or bad. Using an evaluation framework, this research compares the time required for Air Force acquisition programs to declare Initial Operational Capability after successfully achieving "program initiation" at Milestone B (or equivalent). Results are presented and analyzed according to the Air Force Program Executive Officer responsible for each acquisition. Finally, this paper provides conclusions on where JCIDS' impact is most prevalent, and provides recommendations to improve JCIDS now as well as reduce the joint force's operational risk in the future.

INTRODUCTION

Overview of the Study

This research paper will assess the impact of the Joint Capabilities Integration and Development System (JCIDS) on schedules of Air Force Major Defense Acquisition Programs (MDAP). An MDAP is also an Acquisition Category I (ACAT I) program where the Defense Acquisition Executive (ACAT ID) or Component Acquisition Executive (ACAT IC) is designated as the Milestone Decision Authority (MDA) responsible for a service's acquisition program. The Component Acquisition Executive and MDA for Air Force ACAT I MDAP is the Assistant Secretary of the Air Force (Acquisition) (SAF/AQ) when delegated this authority by the Defense Acquisition Executive.

The number of years between Milestone B (or equivalent) and Air Force declaration of Initial Operational Capability (IOC) is the criteria used to evaluate the impact of JCIDS on the Air Force's ability to deliver capability on time since 2003. During the Cold War, the US military approached the acquisition of new weapons based on known threats to US forces. This resulted in the development of unique service systems such as the M-1 Abrams, the Los Angeles Class submarine, and the F-15. In 2003, in response to years of deliberate steps toward "Jointness" the Joint Staff established JCIDS as a major step toward integrated warfighting operations. This scope of this paper is, therefore, focused on the impacts of JCIDS from a schedule perspective only.

The Nature of the Problem

In 2003, the Department of Defense (DoD) dispensed with the Requirements Generation System (RGS) and established the Joint Capabilities Integration and Development System (JCIDS). The intent of JCIDS was to streamline the Joint Staff's oversight of acquisition

programs, ensure “Jointness” and interoperability, and subsequently, reduce redundant requirements across service portfolios. JCIDS finally gave the Joint Staff a mechanism for purview over all potential MDAP within each service. Thus, programs “born joint” via JCIDS or adopted by the process should be more complex and subject to more oversight, while some programs receive additional proponentcy if it fills a priority capability gap. Therefore, the second order effect is JCIDS would impact the time it takes to meet requirements, including those that are service unique.

Based on this institutional change, cycle times before and after JCIDS should be compared between Milestone B (or equivalent) and IOC to determine its consequence on Air Force Acquisition Category ID/IC programs. Non-space and missile acquisition programs are of primary interest because these systems historically follow the framework of Department of Defense Instruction (DoDI) 5000.02, *Operation of the Defense Acquisition System*. Legacy capabilities fielded through the “threat-based” RGS are recently highlighted as examples of how rapidly the US countered the former Soviet Union’s proliferated threats. No comparison of yesterday’s requirements processes to today’s “threat informed” JCIDS, however, has ever been accomplished. Finally, the Air Force’s stagnating operation and maintenance account faces increasing pressure in the coming years and fielding the right mix of affordable, modernized capabilities on time remains vital. Time (Milestone B to IOC) is truly money.

Purpose of the Study

The purpose of this study is to determine if JCIDS has had a lasting impact, either positive or negative, on the Air Force’s ability to develop, procure and field warfighting capability. Did JCIDS result in longer program schedules or have timelines shortened to achieve IOC vice the service processes of the past? The basic criteria to evaluate and compare before and

after JCIDS has remained constant over time. Before and during the RGS, Full Scale Development (FSD) Decisions and Milestone II Decisions were the start of what is commonly known as “program initiation” and the services’ commitment to fund a new acquisition program. Under JCIDS, Milestone B also marks “program initiation” and the official start of a new program or joint capability. In both cases “program initiation” represents the common starting point to evaluate impacts of an evolving requirements process. The race to IOC remains the same over time as the importance of IOC has not changed. IOC is:

Attained when some units and/or organizations in the force structure scheduled to receive a system 1) have received it and 2) have the ability to employ and maintain it. The specifics for any particular system IOC are defined in that system's Capability Development Document (CDD) and Capability Production Document (CPD).¹

The primacy of IOC is a program has successfully passed its operational testing, full rate production is approved and a service is now ready to support Combatant Commander requirements with the weapon.

Research Question

Because of these considerations, this research is focused on the following question: How did capabilities based planning impact product development timelines for Air Force Major Defense Acquisition Programs (excluding space and missile systems)? As the Air Force balances requirements with fiscal uncertainty in the coming years, modernized and interoperable joint capabilities are of increased significance. Air Force weapon systems must achieve IOC on time. Products become increasingly unaffordable to the Air Force budget when schedules are stretched and deliveries delayed.

The Anticipated Significance of the Study

Hon. Frank Kendall, the Under Secretary of Defense for Acquisition, Technology and Logistics since May 2012, emphasizes the importance of shorter schedules and the value of this research. One of the enduring Departmental principles in his Better Buying Power 3.0 guidance is to: “Reduce cycle time while ensuring sound investments.”² This research is significant because it fills a gap in the Air Force’s view of JCIDS and acquisition development schedules from program initiation to IOC. Many studies have reviewed the JCIDS process, or the lengthening timeframes associated with extremely complex and interoperable weapon systems under development today. No post-mortem of the old requirements process compared to JCIDS, however, has ever been undertaken, and this research will answer this question.

Research Methodology and Criteria for Evaluation

This paper will use an evaluation framework to assess schedules of Air Force acquisition programs before and after the establishment of the JCIDS in 2003. An evaluation framework is appropriate because the criterion for first baselining schedules of programs developed before and during the RGS and then comparing them to schedules under JCIDS has not changed over time. This gold standard criterion per Department of Defense Instruction (DoDI) 5000.02 is the timeframe between “program initiation” at Milestone B (or equivalent) and when the Air Force declares IOC. This comparison will develop conclusions about the impact JCIDS has had on the ability of the Air Force to research, develop and acquire MDAP. An MDAP is a program that meets the requirements for such a designation in Enclosure 1 of DoDI 5000.02.

LITERATURE REVIEW

This research relies on primary and secondary sources. The primary source of raw data is the Defense Acquisition Management Information Retrieval (DAMIR) and Acquisition Information Repository (AIR) hosted by the Office of Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L))/Acquisition Resources & Analysis. Unclassified Selected Acquisition Reports containing raw program schedule data required for this research can be accessed in DAMIR/AIR. Annual reports from the Director, Operational Test and Evaluation available from the DoD's webpage and Government Accountability Office (GAO) reports, including their annual *Assessments of Selected Weapon Programs* are additional primary sources of raw data. The GAO, in particular, has published numerous unclassified investigations into the acquisition of individual weapon systems. Web content for major aerospace and defense companies and fact sheets hosted by each of the four services contain vast amounts of required data. The Congressional Research Service and Congressional Budget Office also publish backgrounders, reports and studies to inform Congressional oversight of every aspect of the military, including the length of time to field capabilities. Briefings and program information directly related to weapon systems under evaluation were also used in this study.

Secondary sources include reports and studies of acquisition schedules available from the Defense Technical Information Center, Rand Corporation, the Institute for Defense Analysis and other defense think tanks. Websites for the Office of Inspector General, United States Department of Defense, and the Office of the Secretary of Defense host secondary information in historical reports. Additional secondary sources include scholarly military journals published by the Defense Acquisition University, Air Force, National Defense University and Air Force Historical Support Division. Master's theses and doctoral dissertations submitted in partial

fulfillment of graduation requirements have also been obtained to support this study. Many of these reports have tackled the challenges surrounding requirements, budgeting, and defense acquisition, but none have assessed the impact of JCIDS on Air Force acquisition schedules.

THE DEPARTMENT OF DEFENSE’S BUSINESS OF WEAPONS PROCUREMENT

“Big A” Acquisition and the DoDI 5000.02

The DoD’s business of buying weapons is a complex affair requiring Program Executive Offices (PEO) and program managers to align successfully the requirements, acquisition, and budgeting processes, commonly known as “Big-A” acquisition. Figure 1 reprinted from Department of Defense Instruction 5000.02, *Operation of the Defense Acquisition System*, illustrates the deliberate acquisition steps each Air Force MDAP must successfully achieve to provide warfighting capability.³

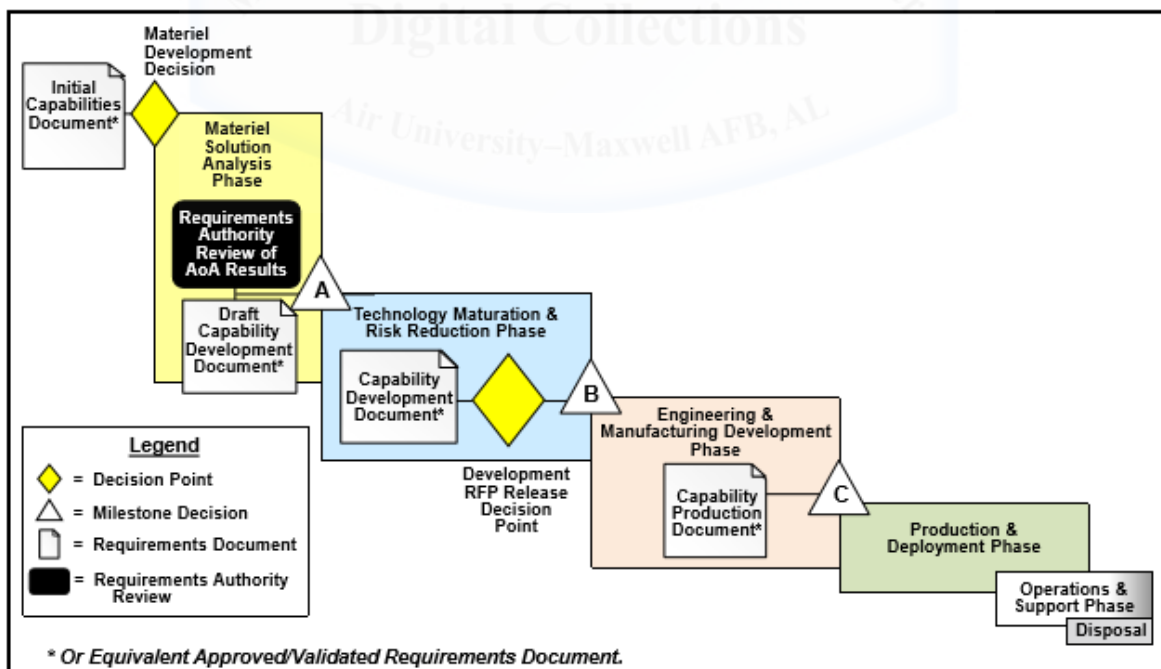


Figure 1. Illustration of the Interaction Between the Capability Requirements Process and the Acquisition Process. – reprinted from Department of Defense Instruction 5000.02⁴

These milestones include both “program initiation” at Milestone B and IOC when designated by the Air Force. Due to the large fiscal investments associated with an MDAP, rarely does the Air Force skip any of these steps unless there is a mature technology that can progress right to the EMD Phase and begin testing. The oversight of requirements and program management activities by both OSD and the Joint Staff tend to force every MDAP through the same checklist-like acquisition process. Accepting risk is rarely rewarded in this highly risk averse culture.

Articulating Joint Capability Needs

The Air Force’s first step in developing and acquiring a new weapon system is to articulate a valid capability need, otherwise known as a requirement. Today, the DoD uses the output of the first step in JCIDS, a Capabilities Based Assessment (CBA), to determine the type of investment required to address a capability gap. The CBA is the initial mechanism for the Chairman of the Joint Chiefs of Staff to deliberately identify recommended materiel solution investments that mitigate threats from our enemies. A materiel solution is a new aircraft, sensor, system, or software, etc. that does not yet exist but must be developed through the acquisition process. Non-materiel solutions in the form of doctrine, organization, training, materiel, leadership, personnel, facility and policy change recommendations for warfighting capabilities will also emerge from a CBA. This type of analysis provides information to balance modernization requirements, procurement accounts, and programmed operations and sustainment (O&S) costs for warfighting operations with research, development, test and evaluation (RDT&E) investments.

If a materiel solution is required as a result of the CBA a service will sponsor a capability document in JCIDS, typically an Initial Capabilities Document (ICD), to document the broad requirements and performance attributes necessary for a successful program. The ICD is the basis for a subsequent Analysis of Alternatives (AoA) conducted in the Materiel Solution Analysis Phase for ACAT I programs. An AoA provides decision makers with the relationships between cost, risk and effectiveness across multiple viable alternatives. The desired end state from a well-executed AoA is the selection of a preferred alternative that has been determined to be the most cost effective for the Air Force. As the AoA ends and the program is approved for entry into the Technology Maturation and Risk Reduction (TMRR) Phase at Milestone A, the next JCIDS document prepared is a draft Capability Development Document (CDD). The CDD is a document focused on the specific capability being developed to close the gap and is the preferred alternative chosen from the AoA. The CDD is also broad enough to consider all the potential increments of capability that could evolve out of the future acquisition. The importance of a CDD validated via JCIDS is that it sets the stage for “program initiation” at Milestone B and entry into the Engineering and Manufacturing Development (EMD) Phase.

With a validated CDD in hand and “program initiation” approved, the Air Force PEO’s Program Offices begin to refine the desired materiel solution, make trades to balance capability with cost constraints, and start developmental testing (DT) in EMD. The primary purpose of the EMD Phase is to mature selected systems and verify achievement of desired requirements through testing. The program must also demonstrate its readiness for the Production and Deployment Phase (P&D) and that the contractor has the capability to produce the item successfully at the desired production rates. The CDD guides the decisions made throughout this

phase because the CDD contains the validated Key Performance Parameters (KPP) and Key System Attributes (KSA) desired by the warfighting community.

In preparation for the P&D Phase, the Air Force sponsors the Capability Production Document (CPD) in JCIDS. The CPD is the document that will guide Full Rate Production (FRP) of the capability and is typically focused on further maturation of the capability demonstrated in the EMD Phase. The CPD should not add new requirements, but instead should refine those requirements most important to the user for a singular increment of capability heading into production. The CPD represents an opportunity for the acquisition, budget and requirements communities to “get it right” in the document as each Air Force MDAP has undergone extensive research, development, test and evaluation to reach this point successfully. The CPD is the last JCIDS document required by the process and can be updated as a fact of life change impacts the program or desired quantities are added or subtracted. All changes to a validated CPD must go through some level of review and validation. Typically requirements that are not KPP are delegated to the Air Force Requirements Oversight Council (AFROC) for validation. The JROC retains its validation authority for KPPs.

There is an important point about JCIDS processes and the documents mentioned here. An ICD, a CDD or a CPD, will be designated JROC Interest if the program has the:

Potential to drive, ACAT I/IA programs, or where the intended level of joint oversight cannot be satisfied by assignment of a lower level JSD [Joint Staffing Designator]. The JROC is the validation authority for JROC Interest Items.⁵

According to the current JCIDS Manual dated 18 December 2015, the estimated timeline to staff a document for JROC validation in JCIDS for a major weapon system is 97 days.⁶ A 97 day timeline assumes there are no problems with the document when it enters JCIDS and all equities can be satisfied as it is being reviewed. In reality these documents take months, even

years to adjudicate and approve. A 2012 report from the Government Accountability Office found the process for JCIDS documents requiring JROC validation ranged anywhere from: “3 months to 17 months.”⁷ A validated CDD is required before release of the request for proposal (RFP) for a contract to develop a new weapon system. The importance of these JCIDS documents and their second order impacts to Air Force acquisition timelines cannot be understated.

The Defense Acquisition Management System (DAMS)

The second major part of Air Force acquisition is the Defense Acquisition Management System (DAMS). The DAMS is the deliberate five step process the Department and the Air Force uses to research, develop and acquire weapon systems. The first step in the DAMS is the Materiel Development Decision (MDD) review. The definition of an MDD review from DoDI 5000.02 is:

*The entry point into the acquisition process for all defense acquisition products; however, an “acquisition program” is not formally initiated (with the accompanying statutory requirements) until Milestone B, or at Milestone C for those programs that enter directly at Milestone C.*⁸

The MDD review provides the Milestone Decision Authority (MDA) with the benefit of early insight into product development planning. The MDA for Air Force MDAP is the Under Secretary of Defense for Acquisition, Technology and Logistics, or an Air Force PEO, who is delegated this authority to make acquisition decisions for Air Force warfighting programs. In addition to the MDD review, Milestones A to C shown in Figure 1 are the primary acquisition decisions where an MDA can approve the acquisition’s entry into the next phase or send it back to do additional research, development, test or evaluation. To successfully conduct an MDD review, the requirement for a materiel solution must exist in the form of an ICD and the MDA must determine if additional analysis, such as an AoA, is required to support the Materiel

Solution Analysis (MSA) Phase. A materiel solution is a requirement for a new warfighting system or piece of equipment to close an existing capability gap. The MSA Phase has taken on increasing importance since the 2008 revision to DoDI 5000.02 which mandated the MDD review and an AoA for all ACAT IC/D programs unless waived by an MDA that can document the required analytical pedigree to proceed directly to Milestone A.

After the MDA approves a program for entry into the MSA Phase and documents the additional analysis required, the AoA is conducted to compare viable alternatives to assess the most operationally effective alternative with the lowest risk and cost within the exiting Air Force “topline” or budget. The results of the AoA lead to the next milestone in the DAMS, Milestone A and entry into the TMRR Phase. The TMRR phase is important because its primary purpose is to leverage competitive prototyping and conduct trade studies that mature a system design achieving the broad requirements outlined in the JCIDS validated ICD. During TMRR, communication with warfighting representatives remains important because the Draft CDD must be validated by the JROC before the Request for Proposal is released to support Milestone B and entry into the EMD phase. The draft CDD is the first opportunity for the acquisition, intelligence, and requirements communities to collaborate on the desired requirements informed by results from the initial testing of prototypes developed in the TMRR Phase. When all these disparate acquisition and requirements activities work as intended, however, the requirements that become KPP, or the most important system characteristics in the draft CDD, reflect the reality of technology as demonstrated in the TMRR Phase.

After the JROC validates the CDD and the program manager has awarded the proposal for the EMD Phase of development, typically a single system is matured via a rigorous design and developmental testing phase. If a single design is chosen for the EMD Phase, typically due to budgetary pressures, it will go through design review iterations via the Department's systems engineering process. As the design matures, a new Air Force MDAP will be subject to significant DT in this phase to demonstrate:

The ability of the system to provide effective combat capability, including its ability to meet its validated and derived capability requirements, including the verification of the ability of the system to achieve KPPs and KSAs, and that initial system production and deployment and OT&E can be supported.⁹

A smart program manager will determine if DT events can be combined with operational testing to reduce risk further and satisfy the requirements of DOT&E for realistic, relevant testing that shows the system will successfully meet operational requirements. A Test and Evaluation Master Plan (TEMP) is the document that guides the required testing in the EMD Phase and while a TEMP is not a statutory requirement, almost all Air Force MDAP are under DOT&E oversight and therefore require this document. As the final design matures and reaches the required Technology Readiness Level, preparations for Milestone C and entry into the next phase, Production and Deployment (P&D) begins.

The P&D Phase is where a new Air Force MDAP begins to add value to the inventory. The system demonstrates its military utility and will continue operational testing to prove out its operational effectiveness, suitability, constraints and limitations. To enter this phase, a Capability Production Document (CPD) validated via JCIDS is required to support the required capabilities, cost, production, and joint interoperability desired of this new system. The CPD supporting the P&D Phase should not change that dramatically from the requirements validated in the CDD during EMD. If the CPD is modified, these changes are commonly known as requirements creep.

Subsequently, more funding and additional OT events are necessary to ensure any new requirements are successfully met. Major activities in the P&D Phase include Low Rate Initial Production (LRIP) and FRP. The purpose of LRIP is to ramp up the defense industrial base deliberately and ensure the new MDAP can be consistently produced before its FRP decision review. The assets fielded as part of LRIP typically require technology refresh and upgrades to match newer versions of the same warfighting systems produced later after FRP. The FRP decision review is where the MDA, oversight community, Joint Staff, and Air Force requirements proponents concur that an MDAP is ready to be mass produced. A successful FRP leads to IOC and equipping the force to the required quantities contained in the CPD. The challenge now is aligning the production rates with available units intended to receive this new platform or piece of equipment.

The Planning, Programming, Budgeting and Execution (PPBE) Process

Finally, the third decision support system in “Big-A” acquisition with a major role in the life of an Air Force weapon system is the PPBE process. The first step described by the Defense Acquisition University (DAU), planning, takes the aggregate guidance at the National and Departmental level and turns this into the Defense Planning Guidance.¹⁰ This guidance then drives the second phase, programming, to resource the guidance and achieve desired strategic end states. The Program Objective Memorandum (POM) is the primary activity of the programming phase where a window of five fiscal years sets forth the resources required to train, organize and equip the services, including acquisition programs. For example, in Fiscal Year 2016 (FY16), the current year, the Department develops the FY18-22 POM. FY17 is then the budget year. The importance of this phase to JCIDS is that the resources allocated to future acquisition programs must have an ICD, CDD, or CPD prepared to support development when

the year of executing that program arrives. The POM is the trigger for the Air Force to initiate the required supporting analysis to sponsor the requisite capability document's development in JCIDS.

Budgeting, the third phase of PPBE, presents the upcoming FY for Congressional enactment in the appropriations language. This takes the form of the Budget Estimate Submission (BES) for the Office of the Secretary of Defense's consideration and the BES becomes the basis for the following FY's President's Budget. Once appropriated, the culmination of the first three phases provide an Air Force PEO and program office with the budget authority to spend funds on a particular acquisition activity in a given FY.

Execution, the final phase, represents the continuous monitoring of program performance by OSD staff and the Air Force staff. Program execution uses established criteria to judge the fiscal health of acquisition programs and make adjustments in the year of execution and recommendations for changes to future fiscal years. The impact of execution related decisions on JCIDS is when programs are delayed and funding reduced due to poor execution; the program takes longer to complete and it becomes more expensive over time due to inflationary factors and the additional time required to complete the acquisition. The date required for the Air Force to achieve IOC likely does not change, but all these first order impacts create second order effects for Air Force MDAP. Combined, the JCIDS, DAS, and PPBE processes must work together to align resources with requirements, intelligence, and acquisition activities that achieve IOC when the Air Force needs it. It is not an easy process, nor is it perfect, but some acquisition successes in the past thirteen years were the Small Diameter Bomb Increment I and the Joint Direct Attack Munition acquisition programs.

Why IOC Matters

It is likely no surprise that the “O” in IOC stands for operational. An MDAP is subject to oversight from Congress, the Service and DOT&E. An Air Force MDAP on DOT&E’s oversight list is subjected to intense scrutiny throughout its development, and the system must be deemed operationally effective and suitable or a combination of the two with limitations. A program’s requirements validated via JCIDS must be measureable, testable, and largely reflect a realistic threat for DOT&E to evaluate the program in a positive fashion. This makes IOC an incredibly challenging hurdle in the business of defense acquisition but remarkably important as a new Air Force system takes its place in the inventory and closes a capability gap for the service. Based on the early analysis conducted as part of JCIDS, the Air Force establishes a desired IOC date in the CDD and CPD based on factors such as the threat, risks to the force, or senior leader direction to close a gap rapidly. Next, the history of the Air Force’s process for validating its requirements before JCIDS will be discussed.

SERVICE STOVEPIPES AND PAROCHIALISM: OPERATIONAL REQUIREMENTS AND THE REQUIREMENTS GENERATION SYSTEM (RGS)

According to a 1974 General Accounting Office study, the Air Force requirements process was streamlined to permit a Major Command (MAJCOM) the latitude to articulate the needs it determined would satisfy higher level Air Force strategy and ultimately Joint Chiefs of Staff guidance in the form of the Joint Strategic Planning System (JSPS).¹¹ Historically, the Air Force would further develop nested plans resulting in a MAJCOM approved requirement known as a: “Required Operational Capability (ROC).”¹² The MAJCOM approved ROC was then submitted to the HQ USAF to begin the process of assessing whether a new weapon system would be developed.¹³ Through multiple levels of internal Air Force review, a ROC surviving

such scrutiny would land on the desk of the Chief of Staff of the Air Force, through the Vice Chief.¹⁴ Finally, the Secretary of the Air Force would decide on the specific course of action required for the proposed acquisition and turn the requirement over to the next phase of acquisition, namely obtaining the required funding for the requirement.¹⁵ While still a largely bureaucratic exercise, the Air Force was truly the master of its own acquisition destiny well before JCIDS and also before the RGS.

In the mid to late 1980s, largely in response to the failure of Operation EAGLE CLAW, the Department moved closer to the tenets of “jointness.” According to Fox, the Department established the Joint Requirements Management Board, (JRMB) in 1984: “to participate directly in acquisition planning and resource allocation and be assured that the strategies and tactics of the unified and specified commands received full support.”¹⁶ The major muscle movement during this time was the Goldwater-Nichols Department of Defense Reorganization Act of 1986. This landmark legislation was the culmination of years of effort, with the intent of forcing the Department to plan and fight in a more unified fashion, particularly at the Unified and Specified Combatant Commands. According to Meinhart, 1986 marked the busiest year in reforming the Department’s weapon buying business toward “jointness” with the January update to DoDD 5100.1, *Functions of the Department of Defense and Its Major Components*, the June renaming of the JRMB to the JROC, and the release of Goldwater-Nichols to drive change.¹⁷ By 1986, the Joint Staff changed the name of this requirements oversight body to the Joint Requirements Oversight Council: “to provide formal advice on major military requirements before they entered the DOD acquisition processes.”¹⁸ The JROC as a standing body remained in place through the establishment of the RGS and today’s JCIDS. Next, the RGS and its relationship with the JROC will be discussed.

The RGS was the predecessor process so formally named for developing and validating service requirements before JCIDS in 2003. The earliest electronic version of the Joint Staff's documented processes for the RGS is from 1997 publication of CJCSI 3170.01 which canceled: "CJCS Memorandum of Policy Number 77, 17 September 1992, "Requirements Generation System Policies and Procedures."¹⁹ The RGS was a bottoms-up approach to what is commonly referred to as threat based planning whereby each Service conducted its own analysis and determined what it needed to combat known foreign threats and achieve national strategies. The Mission Needs Statement and Operational Requirements Document (ORD) were the primary artifacts supporting the acquisition processes. The ORD is today's equivalent of a CDD, a broad document describing the required capabilities to close a focused part of a capability gap. The authority each Service continued to have prior to JCIDS is visible in the CJCSI 3170.01 from 1997 where it states each service defines:

Mission needs and operational requirements, and will develop and coordinate the documentation with the Services and CINCs...The Services may also approve ACAT I program ORDs if granted ORD approval authority by the JROC.²⁰

This is in stark contrast to today's JCIDS process where every ACAT I program is designated "JROC Interest." Today every ACAT I CDD is validated by the JROC, unless delegated, and this provision will be discussed in more detail in the next section on JCIDS.

2003: THE PROMISE OF JCIDS

In June 2003, the DoD embarked on a radical change in its generation of major weapon system requirements. Two wars raged, and the specter of terrorism loomed large over the American people. The processes of the past were no good to deal with the range of enemies faced today. The Department determined interoperable joint solutions would be the best way to fight enemies of the future, and the Joint Staff needed a top down oversight mechanism to ensure

“Jointness” was part of every new program from the start. The problem with bureaucracy is that even the best of intentions can end up creating more problems than they solve.

Then Secretary of Defense Donald Rumsfeld identified the need for a new requirements system in 2002. His memorandum to Gen Pace, then Vice Chairman of the Joint Chiefs of Staff, dated March 18, 2002 is explicit in his displeasure of the existing RGS. Secretary Rumsfeld states:

As Chairman of the JROC [Joint Requirements Oversight Council], please think through what we all need to do, individually or collectively, to get the requirements system fixed. It is pretty clear it is broken, and it is so powerful and inexorable that it invariably continues to require things that ought not to be required, and does not require things that need to be required. Please screw your head into that, and let's have four or five of us meet and talk about it. Thanks.²¹

The time had come to put aside service parochialism and self-interest and begin the march to joint capability development, joint concepts and joint functions. One year later, JCIDS was born.

But was this a positive change for the Air Force? For years, each service articulated its requirements and procured the weapons they determined would resource the national strategy and win our nation's wars. There was nothing fundamentally wrong with either the RGS or the previously validated Statements of Need and Required Operational Capability documents supporting service acquisition planning. These legacy processes resulted in the platforms and weapons that continue to function magnificently in today's Air Force inventory. Each fighter, bomber, tanker, or weapon was designed to counter a known battlefield threat or execute a specific warfighting task. When conflict arose the real challenge became seamlessly integrating the stove piped capabilities of individual fighting forces to achieve unified action. This is one of the primary reasons JCIDS arose out of the long shadow of the Joint Staff's June 2000 publication of *Joint Vision 2020*.

Recently, the Department's pendulum has started to swing back to the processes that existed before and during the RGS. The National Defense Authorization Act for 2016 included specific language to re-insert the service chiefs into major parts of the acquisition process. Specifically, the JROC must consult with the service chiefs during requirements development up through each MDAP's Milestone B review.²² Each service chief will also be required to increase his or her engagement with respective PEOs to provide their input on capability development.²³ This provision of law is only now starting to be realized and could further lengthen the timelines associated with Air Force MDAP achieving IOC when required by placing significant additional bureaucratic burden on Air Force PEOs and program managers. Not only must each MDAP ensure the Air Force acquisition chain of command is in sync with how the program meets requirements, but now Headquarters Air Force will also play a more significant role during each step of the process depicted in Figure 1.

As the Chiefs of Staff of each respective service will now have increased visibility and awareness into the health of their acquisition portfolios, changes to the JCIDS process could also have the opposite effect. Service chiefs may direct acceleration or termination of capabilities depending on their view of acquisition programs. The combination of budget driven decision making within HAF and the increased acquisition oversight could be a positive development for the Department overall, however, in the near term it will most likely cause confusion and delay in successfully achieving IOC for most MDAPs. Only time will tell as this new change is implemented. Finally, the analysis of acquisition schedules before and after JCIDS will be presented in this paper, as well as conclusions and recommendations.

ANALYSIS OF SCHEDULES BETWEEN MS B AND IOC, CONCLUSIONS AND RECOMMENDATIONS

Analysis of PEO Battle Management

Table 1. Years between Milestone B and IOC before and after JCIDS (PEO Battle Management)

PEO Battle Management	MS B or equivalent	IOC or equivalent	Years between MS B and IOC
E-3 Airborne Early Warning and Control System (AWACS) ^a	Jan-73	Mar-77	4.2
E-3 AWACS Blk 40/45 Upgrade	Jul-03	Jan-14	10.5
E-3 AWACS Radar System Improvement Program (RSIP)	Dec-88	Dec-00	12.0
E-8C JSTARS ^b	Sep-85	Dec-97	12.2
JSTARS Recapitalization ^c	Sept-17	Sept-23	6.0
RC-135 ^d Rivet Joint	Mar-62	Jan-64	1.8

Note: MS B and IOC dates for E-3 AWACS Blk 40/45 Upgrade and E-3 RSIP retrieved from each program's Selected Acquisition Report in DAMIR

^a MS B (equivalent) and IOC dates from the February 1973 GAO Report on AWACS, p. 15, and Grier's 2002 article on AWACS, p. 44.

^b MS B (equivalent) and IOC dates from Ulsamer's article and the Air Force Fact Sheet on JSTARS.

^c MS B and IOC dates from the 66 ABW April 2016 Press Release and GAO report GAO-16-329SP, p. 157.

^d MS B (equivalent) and IOC dates from the Air Force Fact Sheet on the RC-135V/W Rivet Joint.

The Air Force's PEO for Battle Management ensures unity of command as a principle of war via command and control and persistent surveillance of the battlespace. The platforms in this portfolio rely on airplane technology from the 1960s and 1970s, and the Air Force has invested in two E-3 AWACS modernization programs since then. A complete recapitalization of the E-8C JSTARS capability is also on the horizon. The RC-135 Rivet Joint was developed out of the existing inventory of KC-135s in the 1960s and continues to fly to this day, however, there is little scholarly information available from open sources about its development prior to IOC

declaration in 1964. All three aircraft were developed before JCIDS in 2003 and all varied significantly in time between FSD, the equivalent of today's Milestone B, and IOC.

The most interesting thing about this data is the current requirement for the JSTARS recapitalization to achieve IOC in just six years, while AWACS upgrades average just over eleven years both before and after JCIDS. The JSTARS recapitalization is an acquisition priority for the Air Force and this is evident in the requirement to reach IOC quickly, assumed to be in the Draft CDD. The impetus behind JSTARS recapitalization is likely due to factors such as increased capability needs, stress on the current airframes, or emerging requirements to operate in complex, high threat environments where the current JSTARS platform is not survivable. Considering the importance of the JSTARS capability to joint and coalition forces, it would be worthwhile for SAF/AQ to see if the JSTARS program office can accelerate the program and achieve IOC sooner. The US enjoys unrivaled command and control of the joint force and given the rise of a resurgent Russia across Eastern Europe and intransigence of the Chinese government in the South China Sea, a recapitalized JSTARS capability is likely required sooner rather than later. Although this data does not show a positive or negative trend on this portfolio after JCIDS was established, it does show that the AWACS and Rivet Joint platforms were fielded rapidly. The rapid fielding of legacy platforms is consistent with the data for fourth generation tactical aircraft discussed next in the PEO Fighter/Bomber portfolio.

Analysis of PEO Fighter/Bomber and PEO Joint Strike Fighter

Table 2. Years between Milestone B and IOC before and after JCIDS (PEO Fighter/Bomber and PEO JSF)

PEO Fighter/Bomber and PEO JSF	MS B or equivalent	IOC or equivalent	Years between MS B and IOC
A-10 Thunderbolt II ^a	Mar-73	Oct-77	4.6
B-1B Lancer ^b	Jan-82	Oct-86	4.7
B-1B JDAM Integration	Jan-95	Dec-98	3.9
B-1B Conventional Mission Upgrade Program (CMUP)	Jan-95	Jan-02	7.0
B-1B CMUP-Defensive System Upgrade Program (CMUP-DSUP)	Apr-97	Mar-02	4.9
B-2 Spirit ^c	Oct-81	Apr-97	15.5
B-2 Radar Modernization Program (RMP)	Aug-04	Mar-10	5.6
B-2 Extremely High Frequency (EHF) Satellite Communications (SATCOM) Increment 1	May-07	Dec-14	7.6
B-21 Long Range Strike Bomber ^d	Oct-15	Mar-25	9.4
B-52 Stratofortress ^e	Feb-51	Apr-52	1.1
F-111 Aardvark ^f	Dec-62	Apr-68	5.3
F-117 Nighthawk ^g	Nov-78	Oct-83	4.9
F-15 Eagle ^h	Jan-70	Sep-75	5.7
F-15 Eagle Passive Active Warning Survivability System (EPAWSS) ⁱ	Jul-16	Jun-21	4.9
F-16 Fighting Falcon ^j	Jan-75	Jan-79	4.0
F-22A Modernization Increment 3.2B	Jun-13	Sep-19	6.3
F-22A Raptor ^k	Aug-91	Dec-05	14.3
F-35A Lightning II ^l	Oct-01	Aug-16	14.8

Note: MS B and IOC dates for JDAM Integration, CMUP, CMUP-DSUP, B-2 RMP, B-2 EHF SATCOM, and F-22A Mod 3.2B retrieved from each program's Selected Acquisition Report in DAMIR.

^a MS B (equivalent) and IOC dates from Drezner and Smith, p. 66.

^b MS B (equivalent) and IOC dates from Rothman, p. 88.

^c MS B (equivalent) and IOC dates from the 2014 Northrop Grumman, Co. Fact Sheet.

^d MS B (equivalent) and IOC dates from the October 2015 press release awarding MS B to Northrop Grumman, Co.

^e MS B (equivalent) and IOC dates from AFHSO White Paper and Air Force Fact Sheet on the B-52.

^f MS B (equivalent) and IOC dates from Rothman, p. 56.

^g MS B (equivalent) and IOC dates from June 1991 Air Force Stealth Technology Review Briefing, p. 17.

^h MS B (equivalent) and IOC dates from Rothman, p. 61.

ⁱ MS B and IOC dates from March 2016 GAO Assessments of Selected Weapon Programs, p. 156.

^j MS B (equivalent) and IOC dates from Rothman, p. 63.

^k MS B (equivalent) and IOC dates from Niemi, p. 71 and the Air Force Fact Sheet on the F-22.

^l MS B and IOC dates from Gertler, p. 8 and Air Combat Command's August 2016 Press Release on the F-35.

These two PEOs are responsible for sustaining the Air Force core missions of air and space superiority and global strike in the fighter and bomber inventory. The data for PEO Fighter/Bomber and PEO JSF is not surprising. Tactical aircraft, on average, took just under five years to achieve IOC after they successfully passed FSD, and all were developed when the Air Force had significantly more control over its requirements validation and acquisition processes. The only tactical aircraft currently in development is the F-35A Lightning II, and this platform's IOC is planned for December 2016. The Air Force is literally putting all of its future air dominance into one capability, and it is taking three times as long as historical development of tactical aircraft if its December 2016 IOC date is achieved. The F-22A's development should have been a harbinger for the harsh reality of timelines associated with developing a complex system of systems such as the F-35A.

Interestingly, upgrades to these previously fielded aircraft also take longer after JCIDS was implemented than it did to actually develop the original platform. The data shows the impact of JCIDS on PEO Fighter/Bomber is that it slowed the Air Force's ability to research, develop and acquire upgrades for fourth generation aircraft and strategic bombers. Capability upgrades managed as MDAP for both fighter and bomber aircraft average slightly over six years to complete, including those still in progress. It is reasonable to infer that joint nature of today's battlespace and requirements to achieve increased interoperability such as the Net-Ready KPP under JCIDS lengthened acquisition schedules in PEO Fighter/Bomber.

Analysis of PEO Intelligence, Surveillance and Reconnaissance and Special Operations Forces

Table 3. Years between Milestone B and IOC before and after JCIDS (PEO ISR and SOF)

PEO Intelligence, Surveillance and Reconnaissance and Special Operations Forces	MS B or equivalent	IOC or equivalent	Years between MS B and IOC
HC/MC-130J Recapitalization ^a	Aug-09	Dec-12	3.3
EC-130H Compass Call ^b	Est.1981	Est. 1983	2.0
U-2 ^c	Nov-54	Apr-56	1.4
MQ-1B Predator ^d	Feb-04	Mar-05	1.1
MQ-9 Reaper	Feb-04	Jun-12	8.3
RQ-4 Global Hawk	Mar-01	Aug-11	10.4
HH-60W Combat Rescue Helicopter	Jun-14	Mar-21	6.7
UH-60 Blackhawk to HH-60G Pave Hawk ^e	May-71	Sep-82	11.3
CV-22 Osprey ^f	Apr-86	Mar-09	22.9

Note: MS B and IOC dates for MQ-9, RQ-4, and CRH retrieved from each program's Selected Acquisition Report in DAMIR

^a MS B and IOC dates from Breede and Griffin's SOFIC presentation, slide 2.

^b MS B (equivalent) and IOC dates estimated from the EC-130H Compass Call Fact Sheet.

^c MS B (equivalent) and IOC dates from Pedlow and Welzenbach, pp. 39 and 94.

^d MS B and IOC dates from the Predator's 2004 DOT&E Annual Report and the Air Force Fact Sheet on Predator.

^e MS B (equivalent) and IOC dates from Rothman, p. 157, and the Air Force fact sheet on the HH-60G.

^f MS B (equivalent) and IOC dates from 1994 DoDIG report on the V-22, p. 2 and Boeing's V-22 Osprey Guidebook, p. 10

The data for PEO ISR and SOF is slightly surprising when considering Combatant Command demand for persistent ISR after the attacks of 9/11. Specifically, Milestone B to IOC for Reaper and Global Hawk averages just over nine years, but these capabilities were employed in combat before the Air Force declared IOC for each platform. Milestone B to IOC for Predator required only one year, but according to Whittle, the Predator also had senior level proponentcy, a history of RDT&E investment and the benefit of BIG SAFARI's streamlined acquisition

processes.²⁴ External forces can have a profoundly positive impact on acquisition and Predator is an example of this phenomena. The Small Diameter Bomb (SDB) Increment I program is another good example of how proponentcy and common sense acquisition principles can expedite fielding of capability. Based solely on the data for PEO ISR and SOF, JCIDS negatively impacted the timelines associated with Reaper and Global Hawk.

The rapid acquisition of SOF capabilities is evident in the ability of the Air Force and United States Special Operations Command (USSOCOM) to quickly develop and field a new capability in the form of recapitalized HC/MC-130J systems. USSOCOM's strength is the command's ability to take service-common platforms like the C-130J and modify it to achieve SOCOM-peculiar requirements in compressed timelines. For HC/MC-130J to achieve IOC in just over three years as an MDAP is astounding in today's environment. An outlier, the CV-22 Osprey is the Air Force Special Operations Command variant of the V-22 Osprey family. The fact it took almost 23 years for the CV-22 to achieve IOC is alarming.

It appears the Air Force is attempting to correct history with the Combat Rescue Helicopter (CRH) acquisition and requires the CRH program manager to achieve IOC in less than five years from the date of this paper. The fact that the Air Force is flying HH-60Gs into combat to conduct personnel recovery missions at 34 years old is a startling revelation. Since the same company that developed the HH-60G, Sikorsky, is under contract to develop the CRH it is somewhat surprising that almost seven years from Milestone B was the original IOC target. The accelerated timeline of the CRH acquisition is consistent with USD(AT&L)'s Better Buying Power principles.

Analysis of PEO Mobility

Table 4. Years between Milestone B and IOC before and after JCIDS (PEO Mobility)

PEO Mobility	MS B or equivalent	IOC or equivalent	Years between MS B and IOC
C-130 Avionics Modernization Program (AMP) ^a	Jul-01	Program Cancelled	
C-130 Hercules ^b	Sep-52	Sep-70	18.0
C-130J Super Hercules ^c	Jun-96	Oct-06	10.3
C-141 Starlifter ^d	Apr-61	May-65	4.1
C-17A Globemaster III	Jan-85	Jan-95	10.0
C-5 Avionics Modernization Program (AMP)	Jan-99	Feb-07	8.1
C-5 Galaxy ^e	Oct-65	Sep-70	4.9
C-5 Reliability Enhancement and Re-engineing Program (RERP)	Nov-01	Feb-14	12.3
Large Aircraft Infrared Countermeasures (LAIRCM)	Sep-01	Jul-04	2.8
T-6A Joint Primary Aircraft Training System (JPATS)	Jan-93	Jun-02	9.4
C-27 Joint Cargo Aircraft (JCA) ^f	Jun-07	Program Cancelled	

Note: MS B and IOC dates for C-130 AMP (MS B only), C-130J (MS B only), C-17, C-5 AMP, C-5 RERP, LAIRCM and JPATS retrieved from each program's Selected Acquisition Report in DAMIR.

^a Program cancelled by the Air Force.

^b MS B (equivalent) and IOC dates from Rothman's report, pp. 93.

^c IOC date from October 16, 2006 AMC Press release.

^d MS B (equivalent) and IOC dates from Rothman's report, p. 96.

^e MS B (equivalent) and IOC dates from Rothman's report, pp. 89-90.

^f MS B (equivalent) from GAO Report: GAO-08-467SP, p. 99. Program cancelled by the Air Force.

PEO Mobility enables Rapid Global Mobility as an Air Force Core Mission.

Interestingly, the PEO Mobility portfolio of programs is the only portfolio with two MDAP cancelled since JCIDS emerged in 2003. In the case of both C-130 AMP and the C-27J, the Air Force deemed both procurements unaffordable within existing budgets, even during wartime and cancelled both programs. This implies that either the requirements or acquisition activities associated with mobility platforms are less efficient when purely compared to other PEOs in this

study. The C-27J JCA was a rather rapid fielding as it was approved to proceed directly to Milestone C, however, its acquisition was cancelled by the Air Force. According to the GAO, the C-130 AMP experienced a critical Nunn-McCurdy breach in 2007 and by 2012 the program was canceled.²⁵ Even after its 2007 re-baseline, the Average Unit Procurement Cost for C-130 AMP continued to grow and the program's 2010 SAR reflects its unstoppable cost growth.²⁶ When acquisition costs grow the root causes are typically procurement reductions and lengthening schedules due to requirements changes. Couple the failures of C-27J and C-130 AMP with the length of time required for C-5 AMP and C-5 RERP to achieve IOC and there is a strong correlation that JCIDS had a negative impact on PEO Mobility after 2003. All acquisition starts with requirements, therefore, the lessons across this portfolio should be documented and shared with the Air Force acquisition community and Joint Staff to improve the process.

Analysis of PEO Tankers

Table 5. Years between Milestone B and IOC before and after JCIDS (PEO Tankers)

PEO Tankers	MS B or equivalent	IOC or equivalent	Years between MS B and IOC
KC-46A Pegasus	Feb-11	Aug-17	6.5
KC-10 Extender ^a	Jan-78	Mar-81	3.2
KC-135 <u>Stratotanker</u> ^b	Oct-54	Jun-57	2.7

Note: MS B and IOC dates for KC-46A retrieved from its Selected Acquisition Report in DAMIR.

^a KC-10 Extender MS B (equivalent) and IOC dates from Sowle, p. 12, and the Air Force Fact Sheet on the KC-10.

^b KC-135 Stratotanker MS B (equivalent) and IOC dates derived from Rothman, p. 98.

PEO Tankers develops aerial refueling capabilities, a force multiplier for the joint force.

PEO Tankers' portfolio is a small set of data in this study. Both the KC-10 and the KC-135

reached IOC extremely fast after each program was initiated. Analogous timelines for military aircraft are unheard of in today's acquisition environment. It does appear, however, the linkage between Better Buying Power and JCIDS was made for the KC-46A procurement with a relatively short procurement schedule relying on commercial technology. With an aggressive IOC date, the Air Force is following the intent of Better Buying Power by making schedule a de facto requirement as USD(AT&L) intends it to be.

Analysis of PEO Weapons

Table 6. Years between Milestone B and IOC before and after JCIDS (PEO Weapons)

PEO Weapons	MS B or equivalent	IOC or equivalent	Years between MS B and IOC
AGM-158 Joint Air to Surface Standoff Missile (JASSM)	Nov-98	Sep-03	4.8
AGM-65 Maverick ^a	Sep-76	Feb-86	9.4
AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM) ^b	Sep-82	Sep-91	9.0
AIM-9M Sidewinder ^c	Feb-76	Mar-83	7.1
AIM-9X Block II Sidewinder	Jun-11	Mar-15	3.7
B-61 Mod 12 Life Extension Program Tailkit Assembly (B61 Mod 12 LEP TKA)	Nov-12	Jun-19	6.6
GBU-31/32/38 Joint Direct Attack Munition (JDAM) ^d	Oct-95	Mar-99	3.4
GBU-39B Small Diameter Bomb Increment I (SDB I) ^e	Oct-03	Oct-06	3.0
GBU-53/B Small Diameter Bomb Increment II (SDB II)	Jul-10	Mar-18	7.7
CBU-105 Sensor Fuzed Weapon/Wind Corrected Munition Dispenser ^f	Nov-85	1997	~12.0

Note: MS B and IOC dates for JASSM, AIM-9X Block II, B-61 Mod 12, and GBU-53/B were retrieved from each program's Selected Acquisition Report in DAMIR.

^a MS B (equivalent) and IOC dates from 1988 CBO Study, p. 48.

^b MS B (equivalent) and IOC dates from the 2000 DOT&E Annual Report for AIM-120 AMRAAM.

^c MS B (equivalent) and IOC dates from Rothman, p. 182, and Oct. 1982 CBO Staff Working Paper, p. 30.

^d MS B (equivalent) and IOC dates from the 1999 DOT&E Annual Report for Joint Direct Attack Munition.

^e MS B and IOC dates from the 2012 Boeing backgrounder on Small Diameter Bomb Increment I.

^f MS B (equivalent) and IOC dates from Maj. Urban's article, p. 35, and the 2013 USAF Almanac, p. 102.

The Air Force's PEO Weapons develops air-to-air and air-to-ground munitions that enable global strike and air and space superiority as Air Force Core Missions. Perhaps not surprisingly, JCIDS has not hindered this PEO's ability to deliver warfighting capability. On average, weapons developed prior to JCIDS required just over seven and a half years to achieve IOC after a successful FSD or Milestone II decision. For the four MDAP in development after JCIDS, each weapon's development cycle between Milestone B and IOC averages five and a quarter years. This Air Force acquisition community appears to understand that two additional budget cycles in the life of an MDAP makes a huge difference. Every extra opportunity for Congress or OSD to review a program that is slow to achieve IOC invites a funding reduction due to poor execution and lengthening procurement. This then increases costs and makes the program unaffordable which ultimately ends up resulting in program cancellation. The refreshing thing in PEO Weapons' data is that this PEO did not let JCIDS stand in the way of fielding weapons during wartime and understood the fact that even in DoD, time is money.

The best example of an Air Force weapon system rapidly achieving IOC after Milestone B is the Small Diameter Bomb Increment I. This weapon was developed out of requirements to increase loadout on a single sortie, reduce collateral damage via a smaller warhead, and conduct precision strike from stand-off ranges. Then Chief of Staff of the Air Force, Gen John Jumper, picked the program's schedule and a fourth quarter FY06 Required Assets Available mandate as its most important priority. Through mature technology, a rolling down-select to a single contractor, focused requirements, and a handpicked system program office the Chief's mandate was met, and the bomb is combat proven.²⁷ The Small Diameter Bomb Increment I program was hailed as an example of how things can get done rapidly when a program and stakeholders focus on what matters to leadership and the process does not dictate the outcome.

Conclusions

This research found JCIDS did have an impact on Air Force acquisition, but it varied across PEOs responsible for non-space MDAP. Most noticeably is the negative impact of JCIDS on the F-35A, upgrades for tactical aircraft, bombers and AWACS, as well as PEO Mobility. Specifically, PEO Mobility's attempts to modernize legacy platforms or introduce new aircraft have run into cost overruns, extended schedules, and cancellations. PEO Weapons, however, harnessed lightning in a bottle and did not let the emergence of a new process hinder its people from the task of fielding new and modernized air-to-air and air-to-ground weapons.

The USD(AT&L)'s Better Buying Power principles are positively impacting the Air Force purely from the perspective of acquisition schedules. While some MDAP after JCIDS were progressing at a rather tepid pace, the tempo is speeding up and for good reason. JSTARS Recapitalization, F-15 EPAWSS, HH-60W Combat Rescue Helicopter, KC-46A Pegasus, B-61 Tailkit Assembly, and AIM-9X Block II Sidewinder all have aggressive IOC dates after the emergence of Better Buying Power in 2010. Interestingly, each Air Force PEO's portfolio in this study is represented with the exception of PEO Mobility. These six Air force MDAP represent billions in RDT&E, procurement and operation and maintenance funding. Each program is vitally important to the recapitalization and modernization of the future Air Force and, on average, achieve IOC in just over five and a half years. Whether the IOC dates for these programs is a result of the intersection of Better Buying Power and JROC oversight or completely by accident is worthy of investigation. These six programs should also be highlighted in the Office of USD(AT&L)'s next *Performance of the Defense Acquisition System Annual Report* and their best practices provided to the acquisition workforce.

Recommendations

An interesting postscript to this research reveals there is very little, if any, connective tissue on the evolution of the Chairman's JROC. Pieces of the JROC's history exist in disparate articles, documents, and reports. For example, if digital copies of the original JROC charter from the mid-80s exist, it remained elusive to this author's research. As JCIDS appears to be changing again, and in many ways back to some of its old processes, this retrospective would be valuable as the service chiefs start to regain a larger role in acquisition and requirements validation. While Meinhart's 2010 article is an outstanding summary of the JROC's chartered role, it is recommended that the Joint Staff document the JROC's history for the benefit of future military historians, leaders, and researchers.

The next revision of CJCSI 3170.01 should include schedule as a mandatory KPP for ACAT I programs. Making schedule a KPP forces program managers to make informed tradeoffs earlier in the acquisition life cycle because the desired IOC date is now presented in the Draft CDD. In the case of the Small Diameter Bomb Increment I acquisition, the Chief of Staff of the Air Force dictated a fourth quarter FY06 Required Assets Available date to the PEO Weapons and the program manager. This type of pseudo KPP clearly articulates what is really important to leadership so other decisions can be made more rapidly to achieve the desired outcome. A validated schedule KPP forces PEOs, the Joint Staff, and intelligence communities to increase collaboration as early as the MSA Phase and focus on the outcome rather than the process. This type of early collaboration is consistent with the principles of Better Buying Power.

As of the date of this paper, the average age of Air Force munitions that have achieved IOC is now 18 years old. The air-to-air and air-to-ground weapons developed in the 80s, 90s, and even after JCIDS may not perform as required in contested, congested, or anti-access/area denial environments. Near peer adversaries continue to develop low observable aircraft, proliferate counter-precision guided munition systems, and upgrade GPS denial and electronic warfare capabilities. To mitigate operational risk to the future Air Force, the Joint Staff should conduct a CBA across the air-to-ground and air-to-air weapons portfolios to ensure sustained US air and space superiority. As previously discussed, a CBA is the Joint Staff's first analytical step in the JCIDS process and determines if materiel or non-materiel solutions are recommended to fill capability gaps during joint warfighting operations.

SAF/AQ should conduct a comprehensive review of the PEO Mobility portfolio in conjunction with the Joint Staff, OSD, Assistant Secretary of the Army (Acquisition, Logistics and Technology), Air Force Materiel Command, and Air Mobility Command. This review should include lessons learned from intra- and inter-theater airlift since September 11, 2001 and also assess the effectiveness, suitability, and survivability of current mobility platforms into the far-term. The data in this research shows this PEO has not been as effective delivering capability either before or after JCIDS, and this warrants a separate study informed by current threats and joint doctrine. At some point in the future, the Air Force will be called upon to execute its core mission of rapid global mobility in anti-access/area denial environments and the challenges this PEO has in delivering capability should be mitigated. The way forward for the future of Air Force mobility must be determined, funds must be programmed, and new acquisition programs initiated now given this PEO's required timelines to deliver capability.

Finally, Congress should direct OSD's Office of Cost Assessment and Program Evaluation (CAPE) to conduct a study of JCIDS in the markup of the next National Defense Authorization Act. In addition to assessing the efficacy of programs achieving desired IOC dates since its 2003 inception, Congress should require CAPE assess: (1) if JCIDS solved the problems it was originally envisioned to fix, (2) what changes the services envision in order for it to work more effectively, and (3) what positive lessons from the last thirteen years can be institutionalized in the next revision of CJCSI 3170.01. This study should be conducted in conjunction with the Joint Staff, the service chiefs in their expanded acquisition roles, Service Acquisition Executives, service PEOs, and ACAT I program managers.



Notes

¹ Defense Acquisition University, “ACQuipedia: Initial Operational Capability (IOC),” last modified 11 May 2015. <https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=87a753b2-99cf-4e63-94dc-9ceab06fc96c> (accessed 17 April 2016).

² Department of Defense, *Better Buying Power 3.0, White Paper*, (Washington, D.C.: Office of the Under Secretary of Defense Acquisition, Technology and Logistics, 19 September 2014), 7.

³ Under Secretary of Defense (Acquisition, Technology and Logistics), *Department of Defense Instruction 5000.02, Operation of the Defense Acquisition System*, 7 January 2015, 5. <http://www.dtic.mil/whs/directives/corres/pdf/500002p.pdf> (accessed May 9, 2016).

⁴ Ibid.

⁵ The Joint Staff, *Manual for the Operation of the Joint Capabilities Integration and Development System*, 18 December 2015, Enclosure E, E-9. https://dap.dau.mil/policy/Documents/2015/JCIDS_Manual_with_errata_through_20151218.pdf (accessed 9 May 2106).

⁶ Ibid., F-2.

⁷ Government Accountability Office, “Guidance and Progress Measures Are Needed to Realize Benefits from Changes in DOD’s Joint Requirements Process.” Report: GAO-12-339, February 2012, 27. <http://www.gao.gov/assets/590/588827.pdf> (accessed 9 May 2016).

⁸ Department of Defense Instruction 5000.02, p. 16.

⁹ Department of Defense Instruction 5000.02, p. 25.

¹⁰ Defense Acquisition Guidebook, “1.2. Planning Programming Budgeting and Execution (PPBE) Process.” n.d., <https://acc.dau.mil/CommunityBrowser.aspx?id=488289> (accessed 10 May 2016).

¹¹ US General Accounting Office, “The Process for Identifying Needs and Establishing Requirements,” June 1974, 10-8, <http://www.gao.gov/products/092321> (accessed 16 July 2016).

¹² Ibid., 10-24.

¹³ Ibid., 10-31,

¹⁴ Ibid., 10-41,

¹⁵ Ibid.

¹⁶ J. Ronald Fox, *Defense Acquisition Reform 1960-2009, An Elusive Goal*, Washington, D.C.: Center of Military History, United States Army, 2011, 134. http://history.defense.gov/Portals/70/Documents/acquisition_pub/CMH_Pub_51-3-1.pdf (accessed 19 July 2016).

¹⁷ Richard Meinhardt, “Vice Chairmen of the Joint Chiefs of Staff and Leadership of the Joint Requirements Oversight Council,” *Joint Forces Quarterly*, (1st Quarter 2010): 145. <http://www.carlisle.army.mil/orgs/SSL/dclm/pubs/Meinhardt%20JFQ%20article%20VCJCS.pdf> (accessed 17 July 2016).

¹⁸ Ibid., 145.

¹⁹ The Joint Staff, *Chairman of the Joint Chiefs of Staff Instruction 3170.01, Requirements Generation System (Formerly MOP 77)*, 13 June 1997, 2. http://webapp1.dlib.indiana.edu/virtual_disk_library/index.cgi/4240529/FID378/PDFDOCS/JEL/CJCS/3170_01.PDF (accessed 10 August 2016).

²⁰ Ibid., A-4.

²¹ United States Marine Corps. *Command and Control/Cyber and Electronic Warfare Integration Division Handbook*, 1 July 2014, 2. https://acc.dau.mil/adl/en-US/720152/file/79590/USN%20-%20Handbook,%20%20C2%20Cyber%20_%20Elect%20Warfare%20Int%20Div%20Handbook,%20July%202014.pdf (accessed 2 July 2016).

²² House, *National Defense Authorization Act for Fiscal Year 2016*, 114th Cong., 1st sess., 2015, HR 1735, SEC 802, Sec 2546a, 29 September 2015, 155. <https://www.congress.gov/114/crpt/hrpt270/CRPT-114hrpt270.pdf> (accessed 5 July 2016).

²³ Ibid.

²⁴ Richard Whittle, “Predator’s Big Safari,” Arlington, VA: Mitchell Institute for Airpower Studies, Air Force Association, August 2011, 11.

²⁵ US Government Accountability Office, "Defense Acquisitions: Assessment of Institute for Defense Analyses' C-130 Avionics Modernization Program Analysis," May 2014, 1. <http://www.gao.gov/assets/670/663652.pdf> (accessed 31 July 2016).

²⁶ Office of the Secretary of Defense, "C-130 AMP Selected Acquisition Report," December 2010, 25. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

²⁷ The author was assigned to the Small Diameter Bomb program office from 2004-2006.



BIBLIOGRAPHY

- Air Force Association. *Air Force Magazine: 2013 USAF Almanac*. Edited by Suzann Chapman. Vols. 96, no. 5. Arlington, VA: Air Force Association. May 2013.
<http://www.airforcemag.com/MagazineArchive/Magazine/2013/0513fullissue.pdf>
(accessed 31 July 2016).
- Breede, David, and James Griffin. 2012. "Program Executive Officer Fixed Wing Aircraft." Special Operations Force Industry Conference. Tampa, FL.
<http://dtic.mil/ndia/2012SOFIC/ThursdayProgramDeepBreede.pdf> (accessed 25 July 2016).
- Congressional Budget Office. *Concurrent Weapons Development and Production*. Study, US Congress, Washington, D.C.: Congressional Budget Office. 1988.
<https://www.cbo.gov/sites/default/files/100th-congress-1987-1988/reports/doc08b-entire.pdf> (accessed 16 July 2016).
- Congressional Budget Office. *Past Trends in Procurement of Air Intercept Missiles and Implications for the Advanced Medium Range Air to Air Missile (AMRAAM)*. Staff Working Paper, US Congress, Washington D.C.: Congressional Budget Office. October 1982. https://www.cbo.gov/sites/default/files/97th-congress-1981-1982/reports/doc20-entire_0.pdf (accessed 20 July 2016).
- Defense Acquisition Guidebook. "1.2. Planning Programming Budgeting and Execution (PPBE) Process." n.d.
- Defense Acquisition University. "ACQuipedia: Initial Operational Capability (IOC)," last modified 11 May 2015.
- Department of Defense. *Better Buying Power 3.0, White Paper*. (Washington, D.C.: Office of the Under Secretary of Defense Acquisition, Technology and Logistics, 19 September 2014).
- Department of Defense. *Department of Defense Press Briefing on the Announcement of the Long Range Strike Bomber Contract Award*. Washington, D.C.: 27 October 2015.
<http://www.defense.gov/News/News-Transcripts/Transcript-View/Article/626146/departments-of-defense-press-briefing-on-the-announcement-of-the-long-range-stri> (accessed 23 July 2016).
- Department of Defense Inspector General. *Review of the V-22 Aircraft Program*. Washington, D.C.: Office of the Inspector General. 14 June 1994.
<http://handle.dtic.mil/100.2/ADA375160> (accessed 25 July 2016).
- Director, Operational Test and Evaluation. *Annual Report: AIM-120 AMRAAM*. Annual Report, Washington, D.C.: Office of the Director, Operational Test and Evaluation. 2000.

- <http://www.dote.osd.mil/pub/reports/FY2000/pdf/af/00amraam.pdf> (accessed 27 February 2016).
- Director, Operational Test and Evaluation. *Annual Report: JDAM*. Annual Report, Washington, D.C.: Office of the Director, Operational Test and Evaluation. 1999.
<http://www.dote.osd.mil/pub/reports/FY1999/pdf/af/99jdam.pdf> (accessed 27 February 2016).
- Director, Operational Test and Evaluation. *Annual Report: RQ/MQ-1 and MQ-9 Predator Unmanned Aerial Vehicle System*. Annual Report, Washington, D.C.: Office of the Director, Operational Test and Evaluation. 2004.
<http://www.dote.osd.mil/pub/reports/FY2004/pdf/af/2004RQ-MQ-1andMQ-9PredatorUAV.pdf> (accessed 27 February 2016)
- Don Sowle Associates, Inc. *Simplifying Contracts for Commercial Systems: A Case Study of DoD Acquisition of Commercial Systems and Components*. Case Study, Arlington, VA: Don Sowle Associates, Inc. 1980. <http://www.dtic.mil/docs/citations/ADA084973> (accessed 16 July 2016).
- Drezner, Jeffrey, and Giles Smith. *An Analysis of Weapon System Acquisition Schedules*. Santa Monica, CA: RAND Corporation, December 1990.
<http://www.dtic.mil/dtic/tr/fulltext/u2/a254271.pdf> (accessed 23 July 2016).
- Fox, Ronald. *Defense Acquisition Reform 1960-2009, An Elusive Goal*. Washington, D.C.: Center of Military History, United States Army, 2011.
- Gertler, Jeremiah. *F-35 Joint Strike Fighter (JSF) Program*. Washington, D.C.: Congressional Research Service, February 2012. <http://www.dtic.mil/dtic/tr/fulltext/u2/a590244.pdf> (accessed 23 July 2016).
- Government Accountability Office. *Defense Acquisitions: Assessment of Institute for Defense Analyses' C-130 Avionics Modernization Program Analysis*. GAO Report: GAO-14-547R. Washington, D.C.: GAO, May 2014.
- Government Accountability Office. *Defense Acquisitions: Assessments of Selected Weapon Systems*. GAO Report: GAO-08-467SP. Washington, D.C.: GAO, 2008.
<http://www.gao.gov/assets/280/274156.pdf> (accessed 16 July 2016.)
- Government Accountability Office. *Defense Acquisitions: Assessments of Selected Weapon Systems*. GAO Report: GAO-16-329SP. Washington, D.C.: GAO, March 2016.
<http://www.gao.gov/assets/680/676281.pdf> (accessed 23 July 2016).
- Government Accountability Office. *Guidance and Progress Measures Are Needed to Realize Benefits from Changes in DOD's Joint Requirements Process*. GAO Report: GAO-12-339. Washington, D.C.: GAO, February 2012.
- Grier, Peter. *A Quarter Century of AWACS*. Air Force Association, Arlington, VA: Air Force Magazine, 2002.

<http://www.airforcemag.com/MagazineArchive/Documents/2002/March%202002/0302awacs.pdf> (accessed 17 July 2016).

Meinhart, Richard M. "Vice Chairmen of the Joint Chiefs of Staff and Leadership of the Joint Requirements Oversight Council." *Joint Force Quarterly*, issue 56 (1st Quarter 2010): 144-151.
<http://www.carlisle.army.mil/orgs/SSL/dclm/pubs/Meinhart%20JFQ%20article%20VCJCS.pdf> (accessed 17 July 2016).

Niemi, Christopher. "The F-22 Acquisition Program, Consequences for the US Air Force's Fighter Fleet." *Air and Space Power Journal* (Air Force Research Institute), 2012.
<http://www.dtic.mil/dtic/tr/fulltext/u2/a567480.pdf> (accessed 23 July 2016).

Northrop Grumman Corporation. *The B-2 Spirit Stealth Bomber Turns 25*. Falls Church, VA: 9 July 2014.
http://www.northropgrumman.com/Capabilities/B2SpiritBomber/Documents/pageDocuments/B-2_25th_Anniversary_Fact_Sheet.pdf (accessed 23 July 2016).

Office of the Secretary of Defense. "Selected Acquisition Report: AIM-9X Block II Sidewinder (AIM-9X Blk II)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: B-1 Conventional Mission Upgrade Program-Computer Upgrade (B-1 CMUP-COMPUTER UPGRADE))." December 1997. From Defense Acquisition Management Information Retrieval.
<http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: B-1 Conventional Mission Upgrade Program-Defensive Systems Upgrade (B-1 CMUP-DSUP)." December 1997. From Defense Acquisition Management Information Retrieval.
<http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: B-1 Conventional Mission Upgrade Program-Joint Direct Attack Munition (B-1 CMUP-JDAM)." December 1997. From Defense Acquisition Management Information Retrieval.
<http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: B-2 Radar Modernization Program (B-2 RMP)." September 2011. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: B-2 Extremely High Frequency SATCOM and Computer Increment 1 (B-2 EHF Inc 1)." December 2015. From Defense Acquisition Management Information Retrieval.
<http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: B61 Mod 12 Life Extension Program Tailkit Assembly (B61 Mod 12 LEP TKA)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: C-5 Avionics Modernization Program (AMP)." September 2010. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: C-5 Reliability Enhancement and Re-engining Program (C-5 RERP)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: C-130 Avionics Modernization Program (AMP)." December 2010. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: C-130J Hercules Transport Aircraft (C-130J)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: Airborne Warning and Control System Block 40/45 Upgrade (AWACS Blk 40/45 Upgrade)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Airborne Warning and Control System (AWACS) Block Upgrade Program (RSIP) (E-3) (AWACS RSIP (E-3))." December 2003. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: C-17A Globemaster III." September 2010. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: Combat Rescue Helicopter (CRH)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: F-22 Increment 3.2B Modernization (F-22 Inc 3.2B Mod)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: Joint Air-to-Surface Standoff Missile (JASSM)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

Office of the Secretary of Defense. "Selected Acquisition Report: Joint Primary Aircraft Training System (JPATS)." September 2013. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>

- Office of the Secretary of Defense. "Selected Acquisition Report: KC-46A Tanker Modernization (KC-46A)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>
- Office of the Secretary of Defense. "Selected Acquisition Report: Large Aircraft Infrared Countermeasures (LAIRCM)." September 2011. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>
- Office of the Secretary of Defense. "Selected Acquisition Report: MQ-9 Reaper Unmanned Aircraft System (MQ-9 Reaper)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>
- Office of the Secretary of Defense. "Selected Acquisition Report: RQ-4A/B Global Hawk Unmanned Aircraft System (RQ-4A/B Global Hawk)." December 2014. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>
- Office of the Secretary of Defense. "Selected Acquisition Report: Small Diameter Bomb Increment II (SDB II)." December 2015. From Defense Acquisition Management Information Retrieval. <http://www.acq.osd.mil/damir/>
- Pedlow, Gregory, and Donald Welzenbach. *The CIA and the U-2 Program, 1954-1974*. Washington, D.C.: History Staff Center for the Study of Intelligence, 1998. Document is now declassified, <https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/books-and-monographs/the-cia-and-the-u-2-program-1954-1974/u2.pdf> (accessed 25 July 2016).
- Rothman, M. B. *Aerospace Weapon System Acquisition Milestones: A Data Base*. Santa Monica, CA: RAND Corporation, 1987. <http://www.dtic.mil/dtic/tr/fulltext/u2/a194386.pdf> (accessed 16 July 2016).
- The Boeing Corporation. *Backgrounder: Small Diameter Bomb Increment 1*. St. Louis, MO: The Boeing Corporation, 2012. http://www.boeing.com/assets/pdf/defense-space/missiles/sdb/docs/SDB_overview.pdf (accessed 17 July 2016).
- The Boeing Corporation. *V-22 Osprey Guidebook*. St. Louis, MO: The Boeing Corporation, 2011/2012. http://www.boeing.com/ospreynews/2011/issue_02/final_2011_2012_guidebook.pdf (accessed 25 July 2016).
- The Joint Staff. *Chairman of the Joint Chiefs of Staff Instruction 3170.01, Requirements Generation System (Formerly MOP 77)*. 13 June 1997.
- The Joint Staff. *Manual for the Operation of the Joint Capabilities Integration and Development System*, 18 December 2015.
- Ulsamer, Edgar. *The Vast Potential of Tactical Technology*. Arlington, VA: Air Force Association, April 1987.

- <http://www.airforcemag.com/MagazineArchive/Pages/1987/April%201987/0487tactical.aspx> (accessed 23 July 2016).
- Under Secretary of Defense (Acquisition, Technology and Logistics). Department of Defense Instruction 5000.02, *Operation of the Defense Acquisition System*, 7 January 2015.
- United States Air Force. *AF declares the F-35A 'combat ready'*. Langley AFB, VA: Air Combat Command Public Affairs, 2 August 2016.
<http://www.af.mil/News/ArticleDisplay/tabid/223/Article/885496/air-force-declares-the-f-35a-combat-ready.aspx> (accessed 3 August 2016).
- United States Air Force. *AMC declares IOC for C-130J*. Edited by Air Mobility Command Public Affairs. Scott AFB, IL, 16 October 2006. <http://www.amc.af.mil/News/ArticleDisplay/Article/148405/amc-declares-ioc-for-c-130j/> (accessed 31 July 2016).
- United States Air Force. "Air Force Stealth Technology Review." DoD Freedom of Information Act Reading Room. 10-14 June 1991.
http://www.dod.mil/pubs/foi/Reading_Room/Science_and_Technology/263.pdf (accessed 23 July 2016.)
- United States Air Force. *Fact Sheet: B-52 Stratofortress*. 16 December 2015.
<http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104465/b-52-stratofortress.aspx> (accessed 23 July 2016).
- United States Air Force. *Fact Sheet: E-8C Joint STARS*. September 2015.
<http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104507/e-8c-joint-stars.aspx> (accessed 23 July 2016).
- United States Air Force. *Fact Sheet: EC-130H Compass Call*. 23 September 2015.
<http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104550/ec-130h-compass-call.aspx> (accessed 25 July 2016).
- United States Air Force. *Fact Sheet: F-22 Raptor*. 23 September 2015.
<http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104506/f-22-raptor.aspx> (accessed 23 July 2016).
- United States Air Force. *Fact Sheet: KC-10 Extender*. 1 October 2003.
<http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104520/kc-10-extender.aspx> (accessed 16 July 2016).
- United States Air Force. *Fact Sheet: MQ-1B Predator*. 23 September 2015.
<http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104469/mq-1b-predator.aspx> (accessed 25 July 2016).
- United States Air Force. *Fact Sheet: RC-135V/W Rivet Joint*. 23 May 2012.
<http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104608/rc-135vw-rivet-joint.aspx> (accessed 23 July 2016).

- United States Air Force. *JSTARS Recapitalization moving forward with radar risk reduction*. Ed. Patty Welsh. Hanscom AFB, MA, 4 April 2016.
<http://www.hanscom.af.mil/News/Article-Display/Article/846717/jstars-recapitalization-moving-forward-with-radar-risk-reduction> (accessed 23 July 2016).
- United States Marine Corps. *Command and Control/Cyber and Electronic Warfare Integration Division Handbook*, 1 July 2014.
- Urban, Michael. "Sensor Fuzed Weapon Tailor Made for Today's Air Force: Maintaining Design Currency into Production." *Program Manager*, November-December 1994.
<http://www.dau.mil/pubscats/PubsCats/PM/articles94/urban.pdf> (accessed 31 July 2016).
- US Congress, *National Defense Authorization Act for Fiscal Year 2016*. 114th Cong, 1st sess., H. R. 1735. *Conference Report*. no. 114-270, 29 September 2015.
- US General Accounting Office. *Airborne Warning and Control System*. Staff Study. Washington, D.C.: US General Accounting Office, 1973.
<http://www.gao.gov/assets/80/78782.pdf> (accessed 17 July 2016).
- US General Accounting Office. *The Process for Identifying Needs and Establishing Requirements*. Washington, D.C.: US General Accounting Office, June 1974.
- Watson, George. "Gen Lemay and the B-52 RFI." *White Paper*. Washington, D.C.: Air Force Historical Support Division. November 2006.
- Whittle, Richard. "Predator's Big Safari," Arlington, VA: Mitchell Institute for Airpower Studies, Air Force Association, August 2011.